

Chapter 1: PERSPECTIVES ON DESIGN RESEARCH

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THE AIM OF THE BOOK

History shows that humans are capable of designing remarkable things: bridges, skyscrapers, dams, cities, the Internet and, less glamorously, sewers and transport systems spring to mind immediately. There are also more subtly extraordinary achievements, including bureaucracies, organizations, IT-systems and processes that allow people to work better together. All of these innovations involve, and are driven by, research. Yet a clear definition of the relationship between design and research is elusive. It is certainly not linear.

The complexity and potential impact of contemporary problems, from societies' difficulty in designing and implementing IT systems, through defining economic policies for the maintenance of welfare ideals, to climate change, cry out for a better understanding of the relationship between design and research. Such understanding may enable designers and their 'users' to conduct research and inform design more effectively. However, again, the relationship between understanding and action is not linear.

One of the reasons is the emergent nature of design. While humans are able to achieve extraordinary things, they are equally capable of producing incredible waste, destruction and injustice. Indeed, extraordinary ambition and destruction often go together, as is illustrated by innumerable examples. A case in point is the car, designed to provide amazing automobility and flexibility for people, based *inter alia* on research into fuel systems, aerodynamics, and driver psychology. Yet, at the same time, cars are now choking our cities and countrysides with air pollution, CO₂ emissions and congestion, contributing to 1.2 million road deaths annually (WHO 2004) and climate change. According to Thackara (2005: 1), '[m]any of the troubling situations in our world are the result of design decisions'. This is, in no small part, because design is producing multiple effects in complex systems with intended but also many unintended consequences. Nevertheless, Thackara is optimistic, seeing design and designers as part of the solution: 'if we can design our way into difficulty, we can design our way out' (ibid.: 1). This is far from simple, of course, since any attempt at design will be appropriated in unanticipated ways, and with unpredictable 'systemic' intended and unintended consequences.

Environmental problems urgently point to a need for new sustainable research-based designs, such as zero energy housing, more sustainable forms of production and consumption, and 'intelligent' technologies for mobility. This must be synchronized with social innovation in everyday practices, with policies and politics (Urry 2008). All such efforts involve and depend on research from many disciplines – from the social sciences and the humanities to the technical and natural sciences. Design decisions mean a lot to how societies change, and there is a widespread expectation that insights

from research are key to ‘good’ design decisions and outcomes. However just placing knowledge from research before design is insufficient. Indeed, conceiving research to be separate, if not external to, and prior to design, providing objective and comprehensive insight into contexts for design, to inform design, correctly anticipate, effectively control and shape the future, is misleading. History is full of examples where design based on research has been harmful, sometimes in matters of life and death, such as the failure of the computer-aided despatch system that created chaos for the London Ambulance Service in 1992 (Shapiro 2005). The relationship between design and research is complex, but also promises just and sustainable social transformations. Critical enquiry into this relationship is needed. This is what this book is about.

TYPES OF DESIGN RESEARCH

Most design processes involve very many different actors and perspectives. It is therefore not surprising that a huge diversity of actors talk about doing design but find it difficult to identify shared aspects of their practice. In a co-citation analysis comprising design literature cited within the period of 1990-2000, Atwood et al. (2002) conclude that one of the most cited resources of modern design literature is Herbert Simon’s *The Sciences of the Artificial* (1996) in which he describes design as devising ‘courses of action aimed at changing existing situations into preferred ones’ (p. 111). There are also alternative views on design that are often cited in the literature (as described in Atwood et al. 2002: 126ff.): Christopher Jones (1970), for example, describes design as ‘initiating change in man-made things’, while Christopher Alexander (1964), who discusses design in architecture, characterizes it as ‘the process of inventing physical things which display new physical order, organization, forms, in response to function’. From the point of view of urban planning, Horst Rittel (1984) describes design as ‘structuring argumentation to solve “wicked” problems’, while Donald Schön (1983, 1987), who studied how designers work and learn, views design as ‘a reflective conversation with the materials of a design situation’, and Pelle Ehn (1989), representing a Scandinavian approach to Participatory Design describes design as ‘a democratic and participatory process’; while Jens Rasmussen et al. (1994) and Kim Vicente (1999), with a background in Cognitive Systems Engineering, characterize design as ‘creating complex sociotechnical systems that help workers adapt to the changing and uncertain demands of their job’.

Paradoxically, the influence of research on design and design done by researchers are widespread, but studies on how research works in designing are not. Across different disciplines, this book is in search of a deeper understanding of the relations between design and research. Broadly speaking, we discuss three different types of design-research relations and, building on (Cross 1995, 2006, 2007), we argue that much can be learned from exploring and, in some cases, combining these three perspectives:

- Research *for* design (research-based design).
- Research *into* design (research analysing how design works).
- Research *through* design (design-based research) – which also include design *through* research.

Firstly, research for design has perhaps the longest tradition, for example in engineering, product or industrial design, computer science, and informatics, where investigations of materials, mechanics and function have long informed design. This tradition dates back to inspirations from scientific design and Le Corbusier's ideas of 'modern architectural science' (de Vries et al. 1992: 20). This form of research for design is especially strong in Design Science, which appeared as part of 1960s attempts to build systematic knowledge applicable to design. Simon's classic work *The Sciences of the Artificial* (2006, 3edn.) is central to this tradition, which is represented in this book by Pries-Heje and Baskerville in chapter 5. Across several disciplines and application fields, Design Science seeks to provide universal models for rational responses to specific design situations. The relationship is usually instrumental and only loosely connected with reflection on how research works in designing. More qualitative approaches that cut across other forms of design research are found in ethnographically informed design, for example in Computer Supported Cooperative Work (Randall et al. 2007).

Secondly, Cross argued that the 1980s and 1990s opened up interesting avenues of research *into* design, with approaches that he later labelled as 'science of design', studying how design processes work (Cross 2006: 98f.). This trend has continued, shifted and expanded to include new theoretical resources such as phenomenology and actor network theory, and several chapters in this book contribute to this field, for example Binder and Nickelsen in chapter 3, Olsen and Heaton in chapter 6, and Lindström in chapter 8.

A separation between design and research is characteristic for the more 'scientific' types of this approach. While research *for* design is functionalist in the way that research is seen to provide knowledge, models and input for designers, in research *into* design, researchers study, describe and analyse how design is done. In both approaches research and design, researchers and designers are held apart, although studies of design practice may inform research for design, and we can imagine a bi-directional move across and between the two forms of design research.

However, in the third kind of design research we discuss in this book, design and research cannot be kept separate. Research works *through* design and design works *through* research. This is, for example, the case in chapter 2 by Simonsen and Hertzum and chapter 10 by Ingemann. Research and design come together, and this becomes central to contemporary design challenges and opportunities, as we will argue below with reference to, among others, Schön's (1983, 1987) influential work on the reflective practitioner, Buchanan's (2001) design revolution, Cross' (2006) designerly ways of knowing, and Nowotny et al.'s (2001) observation of the growing integration of the social, the material and the scientific in 'mode 2' (knowledge) production. Design-based research is about the complex and multi-directional integrations of research and design, where design becomes as much a medium and process of research, as a result. We argue that this move carries inspiration and implications for both the critical enquiry *into* design and the ambitions of making a difference with research *for* design.

HOW DESIGN RESEARCH TAKES PLACE

Design draws together actors who want to change something or create something new. Attractive and wished-for effects are sought; aesthetic experiences in art, architecture, music, design, performance, a new product that satisfies new needs or desires, a new material or technology that alleviates dull or difficult tasks or makes something new possible, a new service or process, a reduction in people's environmental foot prints, higher quality, reduced costs, heightened employee or customer satisfaction, pleasure in experience – the list is endless. Some science and research-based knowledge about how to obtain such results is available but how this knowledge is folded into design effectively, and how it can be synchronized with everyday innovative practice is often unclear.

With this book we would like to contribute to efforts of taking design beyond Design (the creative genius kind). What scholars and practitioners refer to as design facilitation (Buchanan 2001, Thackara 2005) informs our exploration. But we wish to show how designers and researchers are practically going beyond traditions, mobilize different scientific disciplines and address extremely complex design challenges in different contexts in and through idiosyncratic combinations of design and research. The book looks for common characteristics of design processes across disciplines and for how different design perspectives and practices cross-fertilize each other, devising design processes to pursue wished-for effects and outcomes. The book studies examples of how analytical and prescriptive approaches can inform each other.

Our focus is on how interdisciplinary scientific knowledge is put into practice in ways that are helpful for practitioners and others and that make extra-ordinary results possible. Our *objective* is to explore common aspects that characterize a diversity of relations between research and design. Our focus on research through design and design through research raises questions of how design and research practices are integrated and feed each other. This form of design research shapes up as 'mode 2 design'. Nowotny (2004) observes an ever deeper integration of knowledge and society, where research 'is increasingly carried out in the context of application, that is, problems are formulated from the very beginning within a dialogue among a large number of different actors and their perspectives'. Building on this, mode 2 design research acknowledges that research, design and society are heavily integrated, since research contributes to assembling society and society is a constant field of testing and experimenting in research and design.

A central point of the book is to focus on the *processes* involved in doing design. Another central point is that designs emerging from analysis of the *contexts* for design use are much more likely to be successful and of lasting value. Although some designs arises 'out of the blue', research into the various aspects of context for a design-in-the-making are a common starting point. From the analyses of processes and contexts in this book, we learn about the various ways in which research is increasingly being used in the field and how this works in practice in a society where science is deeply

embedded (Novotny et al. 2001). However, as we will explain further later in this chapter, we do not want to overstate novelty and innovation; creativity in designing clearly also involves improvisation beyond great plans and outlines, in making ‘things right’ in the day-to-day (Hallam and Ingold 2007). Our approach thus refers to reflexivity-in-action (Schön 1983, 1987), and through studies of how designs emerge through experimenting in dynamic contexts, our focus leads to a consideration of design research approaches that are socially robust by appreciating the realities of contexts of design and research.

EMERGING DESIGN RESEARCH

‘Design research’ has been developing for many years. One proponent of its revolutionary potentials is Richard Buchanan (2001). Looking back at the history of design since the Renaissance, where design became second to science, he suggests that the 20th century brought a new agenda for design research. Design research takes design beyond its focus on the visual and form, e.g. in graphic design or industrial design, and into academia and interdisciplinary collaborations, now including interaction design, service design and environmental design (ibid.: 11). Design knowledge today is of another kind than traditional scientific knowledge, it is practical and scientific, and it works through synergies. Another central figure in design research is Nigel Cross. In his book *Designerly Ways of Knowing* (2006) he introduces explanations of how design research differs from the kinds of knowledge derived from both (natural) science and humanities. Design is about ‘the artificial world’ and its value is ‘practicality, ingenuity, empathy, and a concern for “appropriateness”’ (ibid.: 2). Design research is thus about problem solutions, and this ‘way of knowing’ has common features across and beyond specific applied fields and professions. Designerly practice involves envisioning and trying out solutions, it requires science, but also intuition, emotion and aesthetic judgement. Thereby designers’ knowledge is constructive with pragmatic abduction, reaching beyond debates over induction versus deduction in science.

To the authors in this book, many of whom have a grounding in the social sciences, the humanities, informatics and engineering, Cross’ way of carving space out for design research between science and humanities reminds of the 20th century fight for a place for social science in-between the ‘two cultures’ of natural science and humanities, (Snow 1959) which was firmly described in the *Report of the Gulbenkian Commission on the Restructuring of the Social Sciences* (Wallerstein et al. 1996). This report argued for opening up the social sciences. Design research, too, aims at interdisciplinary research across the faculties of natural science, humanities and social science. Design research is thus closely related to the kinds of social science which is practically engaged in societies as proposed in *Making Social Sciences Matter* (Flyvbjerg 2001) or public sociology (Burawoy 2005). Buchanan (2001: 20-22) in his example of case studies in design research also points to important inspirations from and synergies with social science methodologies.

However, unlike social science, design research was never in a situation where it had to argue that design matters. Design research had to defend why it was research, rather

than just professional design. As mentioned above, it is not sufficient to argue that research produces better design. Design research needs to explicate its hybrid nature where design and research are integrated. Cross argues for such a position, referring to the not always promising results from attempts of legitimizing design research as a kind of science, from scientific design to design science, not unlike social science's feverous attempts of 'becoming like science' during the 20th century. As we will explain more in the next section, the critical evaluation of these aspirations benefits from Donald Schön's (1983, 1987) postpositivist constructive paradigm.

This discussion fosters recognition of similarities between designerly practices of research, experimentation and intuition and scientific practices. As evident from Science Studies and critical reflection among scientists themselves, the practices of natural science are to a much higher degree than formally recognized about experimental 'designerly' intuition (Galison 1987). The emergence of design research is therefore embedded in the broader reflective transformations of science, education and the knowledge society that science studies, and designers like Buchanan (2001) and Cross (2006) have argued for. Designerly ways of knowing are of a broader relevance than just for traditional design professions. In order to meet the challenges of the present world, designerly ways of knowing are becoming part of what contemporary societies need (Cross 2006: 11).

However, design research is more than programmatic. Over recent years approaches that constructively appreciate the systemic interdependencies between designed objects, use and context, and between designers and the people they are designing for have emerged that provide prototypes. Participatory or collaborative design (see e.g. Greenbaum and Kyng 1991, Schuler and Namioka 1993, Voss et al. 2008) have a long tradition and practices in the area of information technology-based socio-technical innovation, and there are other approaches, such as user-led design in the commercial sector (Von Hippel 2005), and open source design in technology (Ghosh 2006) but also in other areas such as urban design (Fuller and Haque 2008) expanding the scope and ambition of collaborative design approaches. They aim for different forms of collaboration, explicit, open, and collective experimentation, creating not just products and technologies, but also support for creative appropriation, new processes and services, and they productively blur the boundaries between designers, engineers, users, the technical sciences, the social sciences, and the humanities.

FROM MULTI- VIA INTER- TO POST-DISCIPLINARITY

Interdisciplinary design research is emergent, always in the making, alive, a constantly evolving collective effort. In this book, we do not aspire to provide a comprehensive overview or map of the field. Instead, we want to clarify through case studies and reflective accounts what makes design research matter. A variety of research traditions are involved and they differ in their understandings of the relationship between research

and design, as explained with the fourfold typology introduced above with our main interest in the synthetic third: research through design and design through research.

Design research includes analytical and descriptive as well as formative, normative, and prescriptive studies. To better understand design processes – in general and in specific fields – we study the practices of designers who want to change something or make something new. We identify the kinds of processes that are decisive to obtain attractive effects or outcomes. Meanwhile we also discuss the forms of normativity developed in some fields, such as in information systems and participatory design. Scientific disciplines clearly have different traditions in regard to analytical versus prescriptive studies. Our ambition is to point to a complex field of synergies involving, across analysis and prescription, but *not* to *one* meta-narrative. Synergies (chapter 14) emerge from a diversity of sources and relations.

It is no coincidence that in spite of forty years of design research a unified cross-disciplinary (or interdisciplinary) body of theory about design has not been developed (Cross 2007). Many have called upon design researchers to develop such a body of theory. But obstacles to the development of a coherent interdisciplinary theoretical, epistemological and terminological basis for research and theory making, include a lack of agreement about definitions of core concepts and terminology. Furthermore there is poor integration of theories specific to designing and designs. It is thus a question whether it is at all possible to specify and differentiate theories of designing and designs from theories of other fields. Terence Love (2002) suggests that a coherent body of interdisciplinary design theory should address and identify cross-disciplinary relevant definitions of core concepts of design and design-processes.

We doubt that a unified theory of design is possible, feasible, or necessary. However we agree with Love (2002) that theories of design should be developed and related to theoretical debates elsewhere. Knowledge about design research, its possibilities, advantages and difficulties is highly desirable and relevant. To some degree, it is possible to identify general and common themes that characterize different strands of research for, into, and through design. However, we do not want to territorialize a new exclusive field of design research with borders to science, humanities and social sciences. Above we marked some similarities between the formation of social science and of design research, and we could point to other convergences with developments in engineering, science studies and cultural studies. Inclined to such an agenda, this book provides an initial picture of core themes of design research around participation (chapter 2, 7, 11, 12), design exemplars (chapter 4, 5), epistemic and material practices (chapter 3, 6, 10), translations, transitions and actor networks (chapter 3, 8, 9, 13).

We approach design research from a number of different disciplinary and interdisciplinary perspectives – computer science, informatics, sociology, geography, organisational studies, performance design, planning, urban studies and cultural studies, and we discuss many different application areas for design. These include information technologies, engineering, healthcare, safety management, policy, service design, economics, sustainable products, public exhibitions, performance and tourist

experiences. This diversity is not exhaustive but typical of design and design research approaches. The chapters demonstrate the value of different perspectives, exploring how design approaches and processes are understood, theorized and practiced differently. No chapter in this book is ‘monodisciplinary’.

Indeed, given the complex, unpredictable, context dependent and emergent nature of design constraints and opportunities, monodisciplinarity makes little sense. Disciplines – like design, sociology, economy, engineering – study different areas from different perspectives; they separate what needs to be understood as whole, such as the appropriation of new technology, the workings of policy measures, or the effects of a performance. Multi-disciplinarity can facilitate insights into the dynamic complexities of the socio-material-technical cultures design seeks to change. However, sometimes ‘just’ approaching this complexity from different perspectives is not enough. Combining multi-disciplinary insights does not enable an understanding of the lived, emergent, ongoing production of socio-material-technical cultures. Some of the work we present in this book paves the way for more ambitious ‘post-disciplinarity’ (Jessop and Sum 2001, Mayer Harrison et al. 2007), a return to the pre-disciplinary roots of many disciplines whose isolation and specialization was formed in the enlightenment spirit of rational inquiry and the (social) engineering confidence of modernity. Post-disciplinarity fosters study and intervention as a deliberate (although uncertain) holistic ‘mode 2’ endeavour. It enables analysis and design to follow connections all the way through and to forge viable new connections, because they are more mindful of the multitude of dependencies. Post-disciplinary researchers and designers integrate other disciplines’ knowledge and skills, allowing for sophisticated interferences and synergies that enable groups of people to grasp the interconnectedness of factors and domains influencing socio-technical innovation. In our view some of the *interdisciplinary* perspectives and approaches discussed in this book take a step towards *post-disciplinarity*.

CREATIVITY, SOCIAL CHANGE AND EXPERIMENTS

Since design is occupied with making things and processes, creativity is a central theme in design research, but very different interpretations exist. Creativity and innovation are buzz words, for example, in Richard Florida’s best seller *The Rise of the Creative Class* (2002). Economic prosperity and welfare is here associated with the ability to adapt successfully to constant change, inventing novel modes of doing things. Perhaps the most problematic aspect of this work is that these abilities are said to be properties of a particular social class – the creative class. In contrast, anthropologists Hallam and Ingold (2007) are sceptical towards this focus on novelty and design, and suggest to emphasize improvisation and imitation to reach a more generative understanding of creativity. Improvisation sits well with most of the contributions in this book, as it thrives on collaboration and diversity, depends on epistemic and material skills, and the networking abilities and strategies employed in design.

A very different orientation is found in Design Science Research and their interest in technological rules (Van Aken 2004), seen to be capable of guiding design processes, as

suggested in chapter 5 by Pries-Heje and Baskerville and critically discussed in chapter 4 by Scheuer. In contrast to approaches focused on describing and enabling collaborative ‘control’ over improvisation, emergence, translation and situated practice, technological rules are attempts to define general procedures that can be applied in certain situations, categorized according to the types of problems and their contexts. Whether such procedures lead to their goal is discussed in Scheuer’s reflective study of the making of clinical pathways in a psychiatric hospital where he was a development consultant. Technological rules represent a reductive rather than integrative ‘mode 2’ approach to complex systems, in no small part motivated by the limited time and often severe pressures organizational managers experience in search for business or production process improvements.

However different these approaches are, they share a common perspective on design processes. In addition to this, chapter 9 by Holm, Søndergård and Hansen broadens the analysis by discussing the power of technological regimes in their study of attempts of eco-friendly design in building materials. They show how construction industries are heavily structured through such regimes, placing significant and intractable constraints on design. Holm, Søndergård and Hansen argue that new ways of manufacturing materials may succeed in niches, but a deeper societal ‘meta-design’ process is required to manage the institutionalized and path-dependent powers of the existing industrial systems (including types of materials used). ‘Creativity’ takes on a different meaning here, moving away from notions of ‘the unfettered freedom for creativity’ towards practices of improvisation, experimentation and networking to bring about change.

Indeed, one could say more broadly that society and the environment have become the experimental objects. In the name of progress and global economic competitiveness, individuals, societies and the whole planet have become experimental objects (Wynne and Felt 2007). For example, medical interventions, energy and people’s food, are enhanced or created through instrumental application of design, science and technology. Innumerable, both positive and negative examples of emergence of unanticipated problems and opportunities reveal that in contemporary knowledge or information (technology) societies, uncertainty is not residual but immanent, or – to put it more flippantly – a feature, not a bug. Combining Wynne and Felt’s analysis with Nowotny et al.’s concepts of ‘mode 2’ science may, we would like to argue, inform ‘mode 2’ modes of design. That is, designers and their clients/customers/collaborators may use this book to inform their search for a more deliberate, collective and considered integration of science, design and everyday practice. This is critical when we acknowledge that emergence cannot be controlled by more scientific inquiry or more circumspect technological development, it is irrepressible. As a result, all design, science, and technology is inescapably experimental at local, social, global, and environmental scales.

FROM DESIGNERS AND USERS TO RELATIONAL TRANSLATIONS

Much research in design has been around the enormous importance of involving users. This book points to the often problematic or even scapegoat character of users. Chapter

7 by McHardy, Olsen, Southern and Shove underlines the problematic construction of users, often involved in design processes, or just the making of certain kinds of representatives of users. The need of involving a diverse range of users is discussed in several chapters, among others, by Simonsen and Hertzum (chapter 2), and Haldrup and Bærenholdt (chapter 13). However the main problem remains to be, as stressed by chapter 7 by McHardy, Olsen, Southern and Shove that sometimes design processes with far reaching, unforeseeable and irreversible, consequences, did not or could not involve users from the outset. This observation seems valid, whether or not consequences are predicted. The representation and even the ‘making’ of users is therefore not straightforward or democratic – but relational and a matter of struggle.

Similarly, can we always be sure about who the designers are? Designs often emerge without designers being in control. A positive example is the unanticipated up-take of SMS messaging capabilities by predominantly young mobile phone users. Initially intended as an exclusive business service emulating the success of paging technologies, the stampede of unexpected users gave rise to rapid innovation in technology and service models, enabling the use of SMS for everyday communications. A more problematic example is the discovery of the greenhouse effect of CO₂ emissions – embedded in the design of homes, everyday appliances and transport. Many aspects of contemporary societies come into being by such coincidence, unanticipated use or unintended consequence, unpredictably being ‘invented’ for other, not necessarily ‘efficiency oriented’, purposes. Designing technologies and organisations is thus not a simple and straight forward process. From their perspective of interpretive sociology, Olsen and Heaton (in chapter 6) stress, how much any kind of design process is a question of many actors (and we could add non-human actants) acting in ways that aggregate or synchronize in certain ways (or that do not do so, causing frictions, resistance and obstacles). If, then, human intention is involved, trust and coordination among those involved is very important, a condition *sine qua non*.

While some chapters in this book more concretely describe the experiences of processes where the authors have learned directly from their own reflective practices (including chapter 2 by Simonsen and Hertzum, chapter 10 by Ingemann, and chapter 11 by Christrup), other chapters (including chapter 3 by Nickelsen and Binder, chapter 7 by McHardy, Olsen, Southern and Shove, chapter 8 by Lindström and chapter 12 by Samson) explore processes as questions of assembly and translation, inspired by actor network theory (Latour 2005). The approach taken in these studies focuses on practices, revealing the distributed and relational nature of agency, affordances, human and non-human actors. In these and other chapters, researchers detach themselves through reflection and analysis of how designs become, are assembled and translated, rather than just defining *the* designers and specific ‘heroic’ or ‘creative’ actions, and – in the process – research through design and design through research become a ‘middle ground’ (chapter 3 by Nickelsen and Binder) between scientific research and designing practices.

Such approaches emerged in response to critiques of modern rationality and design as a means of controlling the social and the material. Participatory design approaches are

another response to these problems, exemplified in chapter 2 by Simonsen and Hertzum. They describe the process of designing an electronic patient record system and show how representatives of users, along with various designers, are involved in shaping emergent and opportunity-based change, which is not foreseeable. The process is iterative and includes real-world experiments, where designers and users observe and analyse how the design works and take responsibility for emergent outcomes, whether they are positive, wished-for and intended or negative, unanticipated and unintended.

It is a frequently recurrent question how ‘scaleable’ participatory design is, to what kinds of design objects and to what forms of socio-technical organisation such an approach can be taken. Samson, for example, in chapter 12, explores the use of participatory processes for urban planning and in chapter 7, McHardy, Olsen, Southern and Shove imply that design research can support negotiation, necessary struggle and reconciliation between different interests and positions, enabling groups of people to cope more creatively and more circumspectly with the myriad forces involved in heterogeneous processes. This normative assumption that design research should facilitate collaborative management of change is common to all chapters, as is the acknowledgement of open-endedness of the processes involved, and the concluding chapter 14 readdresses the synergies required for this.

THE MATERIAL AND THE SOCIAL IN DESIGN PROCESSES

Several chapters discuss the role of materials or materiality, for example, the eco-friendly affordances of flax (chapter 9 by Holm, Søndergård and Hansen), the quality of historical urban-industrial neighbourhoods (chapter 12 by Samson), and the engaging character of archaeological craftsmanship (chapter 13 by Haldrup and Bærenholdt). The latter highlight that while ‘design’ was not a part of the conceptual toolbox, for example, in tourism studies until recently, use of the term ‘design’ is increasing in areas that more commonly used words like ‘produce’, ‘make’, ‘construct’, ‘build’, ‘fabricate’ or ‘plan’. Latour remarks that design has emerged in numerous professions, and ‘it now extends from details of daily objects to cities, to landscapes, to nations, to cultures, to bodies, to genes, and ... to nature itself in great need of being redesigned’ (Latour 2008: 2). He claims that the use of ‘design’ implies going into a practical engagement with the material ‘envelops’ – things, artefacts and environments – that humans dwell in. Going beyond professional design, interest in the role of things and design in everyday life is growing (Coastal and Dreier 2006, Miller 2010, Shove et al. 2007).

But material aspects matter not only when it comes to the shape and feel of products, technologies, urban spaces. They are also critical in design work. Much design research, including this book, talks about the important role of artefacts and materials. In chapter 2, Simonsen and Hertzum show how the materiality of design can foster change, for example: their technology enables material changes in the organisation of communication between health professionals, allowing them to move from oral reporting to a shared view of issues at hand. In more theoretical terms, Binder and Nickelsen, in chapter 3 and Lindström in chapter 8 explain how the concept of translation in Latour’s work can help design research to understand the continuous

making and shaping of socio-material networks. Binder and Nickelsen investigate the materiality of rubber and of different types of moulding machines to reveal the nature of design as middle ground, while Lindström's case study is about the use of expert economics for policy. This way of thinking also comes through in chapter 12 by Samson, who translates Latour's ideas about 'drawing things together' into architecture and urban planning. Haldrup and Bærenholdt in chapter 13, in addition, suggest the Gibsonian concept of affordance in order to understand the role of museum artefacts such a replica Viking ships in relation to tourist experiences. Material design involves the making of affording artefacts, offering certain possibilities of experience to people, thus further developing classic approaches to design as suggested by Norman (1988).

Daniel Miller (2010: 50), writing on material culture, has an appealing way of describing the humility of objects, powerful because we do not reflect on their capacities for defining sites. Much of the discrete power of models, blueprints and masterplans, for example is exactly because of their non-apparent organisation of interaction - first as an 'immutable mobile' (Latour 2005), organising interactions between interdisciplinary teams of designers, clients, users and contractors, then as the structure for interaction in a place or with an object.

The coming together of the social and the material in design processes is discussed in most chapters in this book. Importantly, attention to the entangled relation between the material and the social reveals how research is done through design and design through research. Design research practice integrates social and material relations in ways where we can no longer make exact judgements of what is inside and outside of designing, where epistemic practices are shown to affect the shape of things, just as much, albeit in different ways, as material endeavours to design and control change. Uncertainty, unpredictability, irrepressible emergence and the lived everyday creativity of collectives makes the world fluid. This fluidity must be matched by sensitive, responsive and 'fluid' practices of researching and designing. It requires processes of researching and designing that enable people to participate responsibly and creatively in the making of researchers, makeshift users, and designers as well as the making of wished-for change.

REFERENCES

- Alexander, C. (1964) *Notes on the Synthesis of Form*, Cambridge, Mass.: Harvard University Press.
- Atwood, M.E., McCain, K.W., and Williams, J.C. (2002) 'How does the design community think about design?', in Amowitz, J., Gaver, W., Mackay, W., Sutcliffe, A., and Verplank, B. (Eds.) *Proceedings of the 4th conference on Designing interactive systems: processes, practices, methods, and techniques*, London: ACM, 125–132.
- Buchanan, R. (2001) 'Design research and the new learning', *Design Issues*, 17:4: 3–23.

- Burawoy, M. (2005) '2004 American Sociological Association Presidential Address: For Public Sociology', *The British Journal of Sociology*, 56: 259–94.
- Coastal, A. and Dreier, O. (Eds.) (2006) *Doing Things with Things: The Design and Use of Everyday Objects*, Aldershot: Ashgate.
- Cross, N. (1995) 'Editorial', *Design Studies*, 16: 2–3.
- (2006) *Designerly Ways of Knowing*, London: Springer.
- (2007) 'Editorial: Forty years of design research', *Design Studies*, 28: 1–4.
- de Vries, M.J., Cross, N., and Grant, D.P. (1992) 'Design Methodology and Relationships with Science', *Proceedings of the NATO Advanced Research Workshop on Design Methodology and relationships with Science*, Eindhoven, The Netherlands, 29 September – 2 October 1992.
- Ehn, P. (1989) *Work-oriented Design of Computer Artifacts*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Florida, R. (2002) *The Rise of the Creative Class*, New York: Basic Books.
- Flyvbjerg, B. (2001) *Making Social Sciences Matter: Why Social Inquiry Fails and How It Can Succeed Again*, Cambridge: Cambridge University Press.
- Fuller, M. and Haque, U. (2008) *Situated Technologies Pamphlets 2: Urban Versioning System 1.0*. New York: The Architectural League of New York.
- Galison, P. (1987) *How Experiments End*, Chicago: University of Chicago Press.
- Ghosh, R.A. (2006) (Ed.) *CODE: Collaborative Ownership and the Digital Economy*, Cambridge, Massachusetts: MIT Press. 2006.
- Greenbaum, J. and Kyng, M. (Eds.) (1991) *Design at Work: Cooperative Design of Computer Systems*, London: Lawrence Erlbaum Associates.
- Hallam, E. and Ingold, T. (Eds.) (2007) *Creativity and Cultural Improvisation*, Oxford: ASA Monographs, Berg.
- Jessop, B. and Sum, N-L. (2001) 'Pre-disciplinary and post-disciplinary perspectives', *New Political Economy*, 6: 89–101.
- Jones, J.C. (1970) *Design methods: seeds of human futures*, London, New York: Wiley-Interscience.

- Latour, B. (1986) 'Visualization and cognition: Thinking with eyes and hands', *Knowledge and Society: Studies in the Sociology of Cultures Past and Present*, 6: 1–40. A revised version can be found in Latour, B. (1990) 'Drawing things together', in Lynch, M. and Woolgar, S. (Eds.) *Representation in scientific practice*, Amsterdam: Kluwer.
- (2005) *Reassembling the Social*, Oxford: Oxford University Press.
- (2008): 'A Cautious Promethea? A few steps toward a philosophy of design (with special attention to Peter Sloterdijk)', Keynote lecture for the Networks of Design meeting of the Design History Society, Falmouth, Cornwall, 3 September 2008, Online. Available HTTP: <http://www.unsworn.org/docs/Latour-A_Cautious_%20Promethea.pdf> (accessed 9 December 2009).
- Love, T. (2002) 'Constructing a coherent cross-disciplinary body of theory about designing and designs: some philosophical issues', *Design Studies*, 23: 345–61.
- Mayer Harrison, H., Harrison, N., Haley, D., Harrison, G., and Fremantle, C. (2007) *Greenhouse Britain: losing ground, gaining wisdom. Touring exhibition*. Online. Available HTTP: <<http://greenhousebritain.greenmuseum.org>> (accessed 11 December 2009).
- Miller, D. (2010) *Stuff*, Cambridge: Polity.
- Normann, D.A. (1988) *The Design of Everyday Things*, New York: Basic Books.
- Nowotny, H. (2004) 'The potential of transdisciplinarity', from Web-conference on 'Rethinking Interdisciplinarity'. Online. Available HTTP: <<http://www.interdisciplines.org/interdisciplinarity/papers/5>> (accessed 25 November 2009).
- Nowotny, H., Scott, P., and Gibbons, M. (2001) *Re-Thinking Science*, Cambridge: Polity.
- Randall, D., Harper, R. and Rouncefield, M. (2007) *Fieldwork for design*. London, Springer-Verlag.
- Rasmussen, J., Pejtersen, A.M., and Goodstein, L.P. (1994) *Cognitive Systems Engineering*, New York: Wiley.
- Rittel, H. (1984) 'Second-Generation Design Methods', in Cross, N. (Ed.) *Developments in Design Methodology*, New York: John Wiley & Sons.
- Schön, D.A. (1983) *The Reflective Practitioner: How Professionals Think in Action*, New York: Basic Books.

- (1987) *Educating the Reflective Practitioner*, San Francisco: Jossey Bass.
- Simon, H.A. (1996) *The Sciences of the Artificial*, 3. edn., Cambridge, Mass.: MIT Press.
- Shapiro, D. (2005) 'Participatory design: the will to succeed', in *Proceedings of the 4th Decennial Conference on Critical Computing: between Sense and Sensibility CC 05*, New York: ACM Press.
- Shove, E., Watson, M., Hand, M. and Ingram, J. (2007) *The Design of Everyday Life*, Oxford: Berg.
- Schuler, D. and Namioka, A. (Eds.) (1993) *Participatory Design: Principles and Practices*, London: Lawrence Erlbaum Associates.
- Snow, C.P. (1959) *The Two Cultures*, Cambridge: Cambridge University Press.
- Thackara, J., (2005) *In the Bubble: Designing in a Complex World*. Boston: MIT Press.
- Van Aken, J.E. (2004) 'Management research based on the paradigm of the design sciences: The quest for field-tested and grounded technological rules', *Journal of Management Studies*, 41: 219–46.
- Urry, J. (2008) 'Innovation, Systems and Synchronisation', paper given to the AIM Fellows Meeting, Imperial College, London, 6th November 2008. Available from urry@exchange.lancs.ac.uk.
- Vicente, K. J. (1999) *Cognitive Work Analysis: Towards Safe, Productive, and Healthy Computer-based Work*, Mahwah, NJ: Lawrence Erlbaum Associates
- Von Hippel, E. (2005) *Democratizing innovation*. Cambridge, Mass.: MIT Press.
- Voss, A., Hartwood, M., Ho, K., Procter, R., Rouncefield, M., Slack, R., and Buscher, M. (2008) *Configuring User-designer Relations: Interdisciplinary Perspectives*. London: Springer-Verlag.
- Wallerstein, I., Calestous, J., Keller, E.F., Kocka, J., Lecourt, D., Mudimbe, V.Y., Mushakoji, K., Prigogine, I., Taylor, P.J., and Trouilloy, M.R. (1996) *Open the Social Sciences: Report of the Gulbenkian Commission on the Restructuring of the Social Sciences*, Stanford: Stanford University Press.
- WHO (2004) *Road safety: a public health issue*, Online available: HTTP: http://www.who.int/features/2004/road_safety/en/ (Accessed 11 November 2008).

Wynne, B. and Felt, U. (eds) (2007) *Taking European Knowledge Society seriously*. European Commission. Online available. HTTP: <http://ec.europa.eu/research/science-society/document_library/pdf_06/european-knowledge-society_en.pdf> (accessed 9 December 2009).